nnegram Spring 2015

Features

- Water Resources Center funds three research projects in annual grant competition

  The Water Resources Center awarded funding to three research projects for 2015. The funded research projects include improving the mechanics in drinking water filtration systems, the effect of invasive mussels on the marine environment, and finding a safe balance between the economic boon of mining operations and sulfite damage to wild rice habitat.

- Customizable onsite system owner's guide goes online

  With over 30 percent of new neighborhoods installing decentralized wastewater systems, the creation of a simplified, individualized web-based operation manual for individual homeowners or those living within a community septic system only made sense.

- Great Lakes, Grand Challenge: Undergrad honors course combines two disciplines and two inspired instructors

  When it comes to environmental issues, most people probably consider scientists to be the thought leaders and change agents. But it is often the world’s great communicators—journalists, essayists, and philosophers, novelists and poets—who succeed in moving society toward shifts in attitude and action that positively impact the environment. Ralph Waldo Emerson, Henry David Thoreau, John Burroughs, Aldo Leopold, and Rachel Carson are among those whose writings have raised awareness about the environmental and conservation challenges that have faced us for decades.

- Sara Heger and the Onsite Sewage Treatment Program are Onsite Installer magazine front page news

  Through wastewater education and research projects, onsite specialist Sara Heger is making a difference for the environment in her home state of Minnesota and across the country.

News

- Spring 2015 Community News

  Call for Abstracts for 2015 Minnesota Water Resources Conference: Deadline Friday May 8.

- Spring 2015 Student News

  The Water Resources Science graduate program welcomes new faculty

- Spring 2015 Resources and Publications

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Improving the (Bio)fouling and Mechanical Resistance of Ultrafiltration Membranes for Drinking Water Production

Principal Investigator (PI) Santiago Romero-Vargas Castrillón will test the effectiveness of graphene oxide (GO) to strengthen the membranes used in ultrafiltration (UF) at water treatment facilities. UF is a membrane-based water separation process widely used in drinking water production. The membrane can become clogged with particles and bacteria, which decreases its effectiveness and can cause complete membrane failure. Castrillón will use GO to improve the resistance of the membrane to mechanical stresses that are common during membrane cleaning and backflushing. In addition, surface modification with antibacterial GO is expected to mitigate bacterial growth on the membrane, a phenomenon known as biofouling. “My research objective is to improve the longevity and effectiveness of ultrafiltration membranes by improving membrane mechanical and interfacial properties,” said Castrillón.

Invasive mussel shells and biogeochemistry of Minnesota lakes

Zebra and quagga mussels, also known as dreissenid mussels, have been the target of much research as scientists seek to understand the effects of dreissenid activities on the cycling of carbon (C) and the nutrients phosphorus (P) and nitrogen (N). Ted Ozersky, (WRS faculty, UMD, LLO) studies the ecological impact of dreissenid shell accumulation and shell breakdown on water resources. “We do not know how much shell there is in different systems, what this shell is made from and what its long-term fate is,” says Ozersky. Under his direction, researchers will measure mussel biomass and shell production and quantity in a set of lakes along a gradient of parameters such as size, invasion history and productivity. Measurements of shell quantity, composition and fate will be combined with information about sampled lakes to produce predictive relationships between lake characteristics and the role of shell material in geochemistry of ecologically important elements such as C, Ca, N and P. The proposed work will potentially contribute to more informed management of dreissenid-invaded waters in Minnesota and elsewhere.

Hydrogeochemical modeling of groundwater controls on sulfate and wild rice in streams

Balancing mining interests and environmental health is a tricky business. This is especially the case now in northern Minnesota, where stringent standards regulating sulfate levels in surface waters aim to protect native wild rice but place strong pressures on mining operations with high sulfate discharge. In a recent reassessment of the standard, the Minnesota Pollution Control Agency presented data supporting wild rice vulnerability when elevated levels of sulfate are converted to sulfide in the porewater of lakes and streams. However, the MPCA study lacked an explanation of site-specific hydrogeochemical mechanisms. Timely clarification of sulfate effect in streams is vital to inform regulations that will affect Minnesota's economy and wild rice habitat. PI Gene-Hua Crystal Ng and co-PI Amy Myrbo seek to clarify the effect of sulfate in streams by evaluating a new conceptual model in which groundwater as well as surface water influences porewater sulfide concentrations. Porewater is defined by the USGS as water occupying the spaces between sediment grains.

"We propose to investigate a new conceptual model in which groundwater also influences porewater sulfide concentrations. We may discover that at some sites, sulfate can be transferred more efficiently to porewater through groundwater transport than through diffusion from surface water, and groundwater may serve to transport available Fe for sulfide immobilization," said Ng.

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ver 30 percent of new neighborhoods installing decentralized wastewater systems, the creation of a simplified, ualized web-based operation manual for individual homeowners or those living within a community septic system only sense.

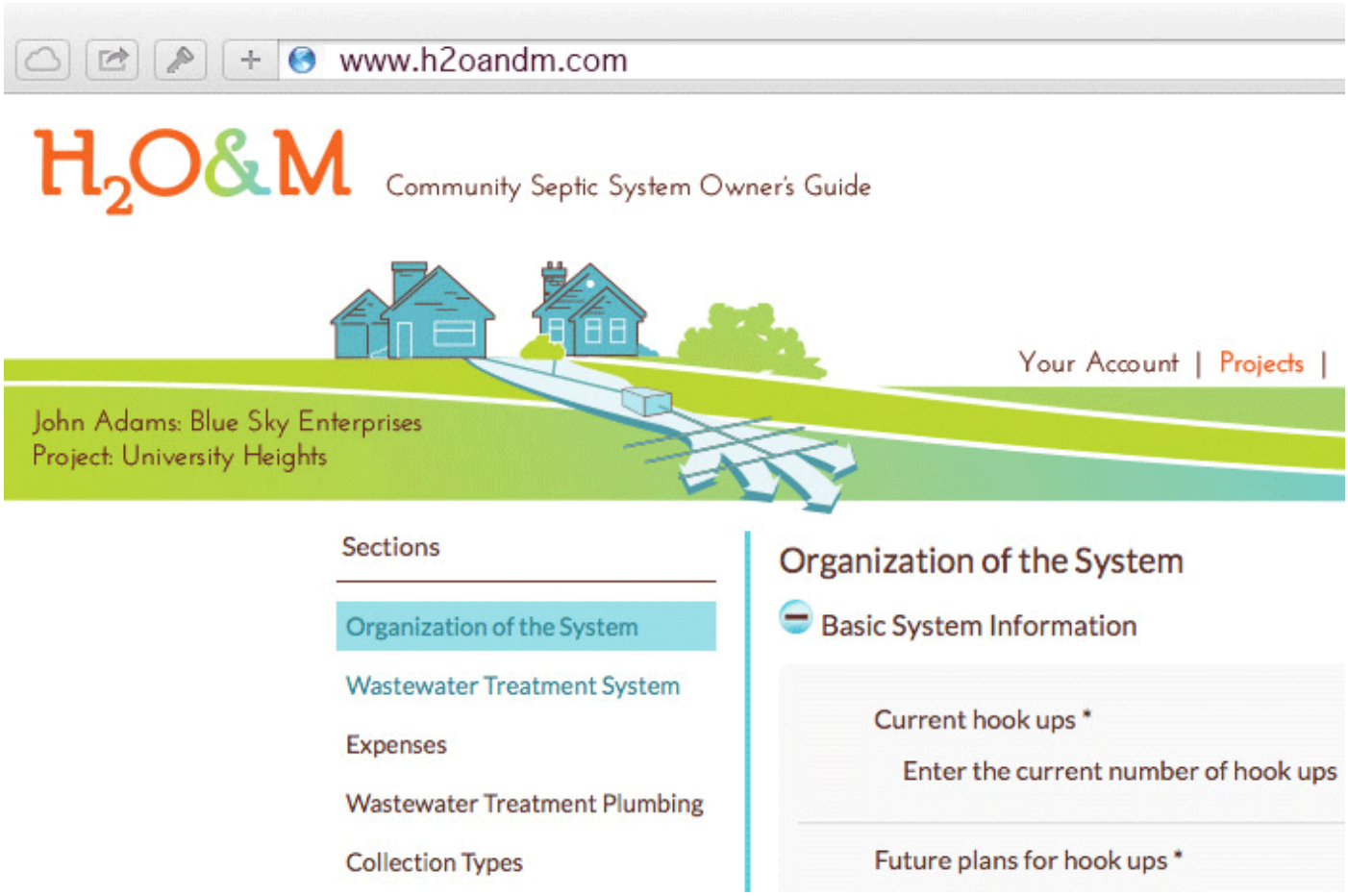
an have the most state-of-the-art onsite wastewater treatment system, but if homeowners are unaware of the on-going, routine maintenance the system requires to properly protect the environment and water quality, the system will deteriorate and public health as well as water quality will be jeopardized," says Sara Heger, the lead member of the team that developed The Community System Owner's Guide.

Christened H20&M The Community System Owner's Guide, the online customizable manual template uses site and system information entered by the homeowner or small community to create a specific plan for operation and maintenance of their onsite treatment systems. Septic system professionals will use the interface to create site specific graphics and language understandable to users, as well as creating customized content that addresses the needs of each system, site and local permitting requirements. The website will also be a resource for septic system designers, septic professionals and facilitators.

Users can save templates and the projects can be modified at any time.

Sara Heger, Dave Gustafson, Kitt Ferrell-Poe, Dan Olson, Nancy Deal, Dendra Best, Shelia Craig and Aaron Wills participated on the project development team which was funded by the USDA National Institute of Food and Agriculture.

The guide will be available in summer 2015.



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eat Lakes, Grand Challenge: Undergrad honors course mbines two disciplines and two inspired instructors

age when man has forgotten his origins and is blind even to his most essential needs for survival, water, along with resources has become the victim of his indifference." --Rachel Carson, The Silent Spring

an use our scientific knowledge to improve and beautify the earth, or we can use it to...poison the air, corrupt the waters, blacken the face of the country, and harass our souls with loud and discordant noises, [or]...we can use it to mitigate or abolish all these things." --John Burroughs, 1912

When it comes to environmental issues, most people probably consider scientists to be the thought leaders and change agents. But it is often the world's great communicators—journalists, essayists, and philosophers, novelists and poets—who succeed in moving society toward shifts in attitude and action that positively impact the environment. Ralph Waldo Emerson, Henry David Thoreau, John Burroughs, Aldo Leopold, and Rachel Carson are among those whose writings have raised awareness about the environmental and conservation challenges that have faced us for decades.

It is this very notion—the integration of science and the humanities—behind the University's undergraduate Honors Program course Our Common Waters: Making Sense of the Great Lakes.

A Bush Foundation grant allowed the University to create honors program courses such as this, which address society's "grand challenges" and are based on a multi-disciplinary approach. Professor of English Dan Philippon and Environmental Chemistry Professor and former Water Resource Center Co-director Deb Swackhamer created the Our Common Waters course.

Swackhamer approached Philippon about this team-teaching opportunity. They discussed a variety of possible themes and avenues that would most effectively tap into Philippon's specialty in environmental humanities—including history, literature, and ethics courses—while complementing Swackhamer's expertise in science.

According to the course catalog, the course "seeks to demonstrate how solving environmental problems in the region will require not only science and technology, but also individual action and public policy that is consistent with the ethics and

values of society."

Our Common Waters emphasizes water in nature and society—the chemical, ecological, and geological aspects of the Great Lakes as well as their history, economic ramifications, cultural contributions, and the laws and regulations that impact them. "The class discussion includes global water crises and moves onto water issues in the U.S., then hones in on the upper Midwest," Phillipon explains. "Once on the shores of the Great Lakes, we look at the impact of the lakes on native culture, European settlement, and modern attitudes toward resource exploitation and commerce. "

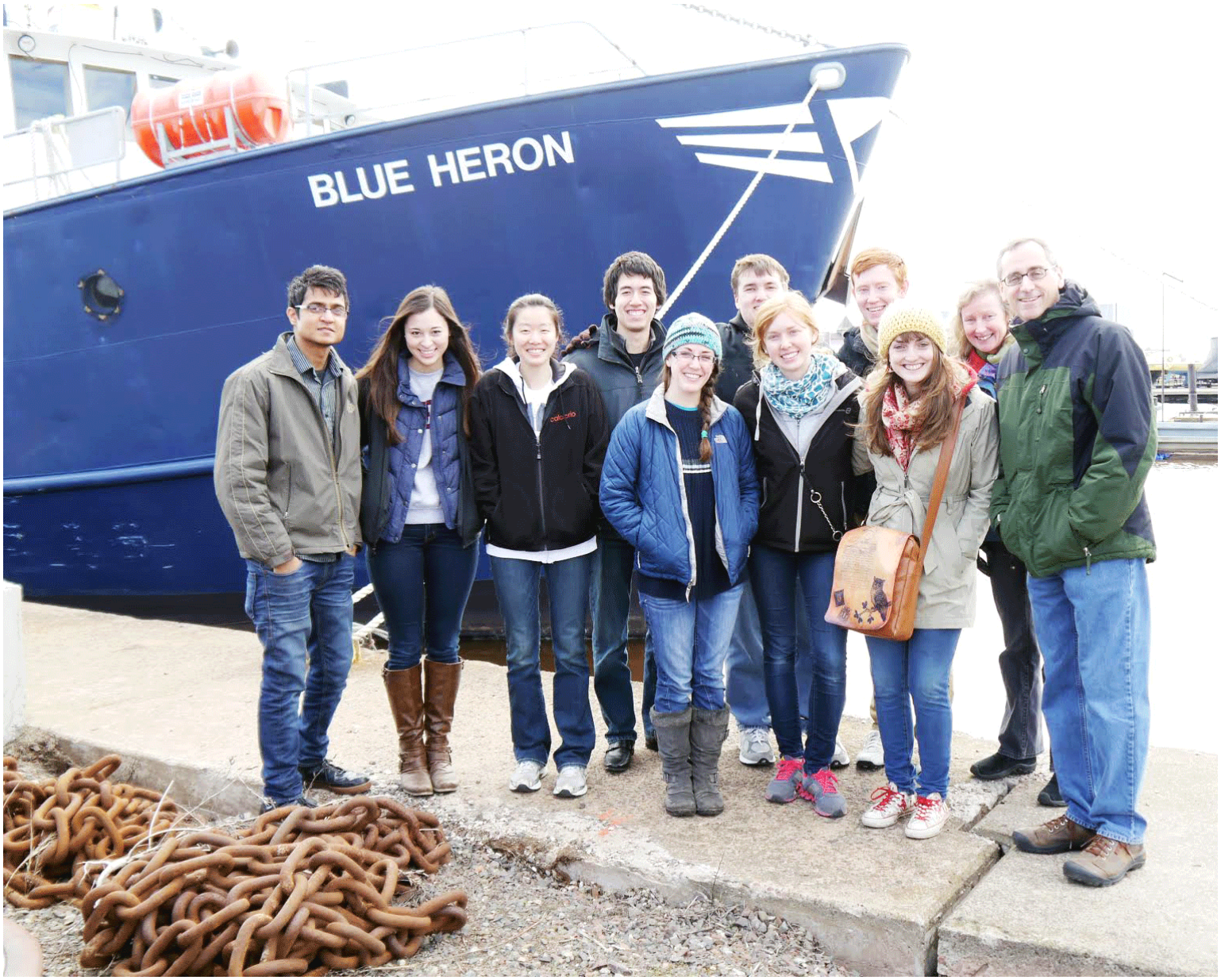
The course has attracted students from a wide range of majors, including design, liberal arts, agriculture, and physics. Last spring, Our Common Waters got the attention of University Honors Program freshman Kristen Anderson. Anderson, who hails from Red Wing, was lured by its class size and rigorous academic syllabus, field trips and creative writing assignments, and emphasis on environmental issues.

Now a second-year political science major with a focus on environmental policy and advocacy, Anderson credits the course with shaping her academic decisions and inspiring her extracurricular involvement as legislative staffer with the Minnesota Student Association.

"The class melded history, economics, ecology, policy, and culture and gave me a great foundation for all the interconnections between public policy and environmental advocacy," says Anderson, who plans to study environmental policy in Germany this fall.
Part of the students' grade is to develop an action plan for solving a "grand challenge" related to water. These have included a plan to reverse the flow of the Chicago River and modeling the frequency of shipwrecks.

For professors Philippon and Swackhamer, the success of this class is a "grand challenge" they fully embrace. "Professors Deb and Dan are a dynamite, dedicated team—they're genuine and supportive, and they care passionately about each other's area of expertise," says Anderson. Philippon says teaching the course with Swackhamer has been "a fantastic experience."

"The only way we're going to solve environmental issues is by recognizing the human components in addition to understanding the science and technology," Philippon says. "It takes scientists and nonscientists to create an atmosphere of social change. This course is as much about applied sciences as it is applied humanities."



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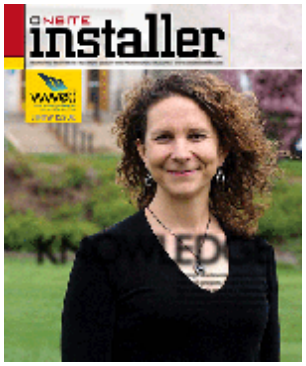
ra Heger and the Onsite Sewage Treatment Program are site Installer magazine front page news



Heger didn't set out to be an expert in onsite wastewater treatment. It just turned out that way. engineer for the University of Minnesota Onsite Sewage Treatment Program, Heger spends ne providing education at professional conferences, consulting on troubled systems and g on projects to improve the industry.

From childhood on, her experiences lined up to mostly bring her back to where she began- working the ground. She understands the industry because she lives it, and after 16 years as a wastewater engineer she has a broad insight into the issues facing the industry.

Read full article

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ring 2015 Community News

or Abstracts for 2015 Minnesota Water Resources Conference: Deadline Friday May 8.

nderson (former WRC co-director) was awarded a lifetime achievement award from the Minnesota Onsite Wastewater iation (MOWA) at their January 2015 meeting. The award recognizes individuals whose careers in the field of onsite water treatment are exemplary, with outstanding service, dedication and accomplishment for MOWA. Anderson ed center) began conducting research and providing education on septic systems in 1971. He and Roger Machmeier started the Onsite Sewage Treatment Program (OSTP) at the University of Minnesota resulting in one of the best education and certification programs in the US. Anderson's soils expertise, combined with Machmeier's engineering knowledge created a program which trains septic system installers, designers, inspectors and service providers. Anderson also helped develop and update Minnesota Rules during over 30 years as chair of the Septic System Advisory Committee. Presenting the award, OSTP's **Sara Heger** said: "Jim's example taught the septic industry three important things: the value of getting your hands dirty, the value of belonging to a state association and the impact that one person can make."

Les Everett and **Ann Lewandowski** (WRC) received a grant from the McKnight Foundation to train staff of three Minnesota watersheds on use of the Ag Conservation Prioritization Framework (ACPF) and evaluate the feasibility and usefulness of employing the ACPF in working with landowners to select and implement conservation practices. The ACPF was developed by Mark Tomer's group at the USDA Agricultural Research Service lab in Ames, Iowa. It uses GIS data layers, including LiDAR digital elevation, to map the most effective locations for specific types of conservation practices to reduce nutrient and sediment loads. Results of the evaluation will be used to guide adjustments to the ACPF and develop training materials for its use. A description of the ACPF was published in a 2013 article in the Journal of Soil and Water Conservation.

John Gulliver (WRS faculty, CE) moderated and organized the session "Current and Unfolding LID and Stormwater BMP Research at the University of Minnesota," for the Minnesota Water Resources Conference, St. Paul, MN, October 14-15, 2014.

Tom Johnson (WRS faculty, LLO) recently completed a research cruise on Lake Malawi, East Africa, bringing to an end a four-year program by LLO scientists of monitoring the temperature and seasonal variability of settling sediment, plankton, and other organic matter in that great lake of the East African Rift Valley. Lake Malawi is undergoing change as a result of

global climate change and major expansion of agriculture in its drainage basin. LLO scientists are providing valuable baseline information to the Malawi government on the current state of the lake. Johnson also gave an invited plenary address, "A progressively wetter climate in Southern East Africa over the past million years," at the annual meeting of the African Quaternary Association in Cape Town, South Africa, in early February 2015.

Carlie LaLone (Post/Doctoral Associate, WRC) and a team of EPA researchers were recognized by Environmental Protection Agency administrator Gina McCarthy for developing a software application to inform the use of pathway-based biological data to predict the potential effects of chemicals in a wide range of animal species. This computational tool, titled Sequence Alignment to Predict across Species Susceptibility (SeqAPASS), facilitates rapid and quantitative assessment of the similarities of specific proteins across thousands of species. The research team also includes Gerald Ankley and Daniel L. Villeneuve.

The Large Lakes Observatory (LLO) hosted a forum which explored ideas for improving Limnology graduate courses. Recent turnover in faculty at LLO has spurred development of a new graduate curriculum beginning fall of 2016. Discussions focused in part on the diverse needs of students, making the program more enticing, innovative, and inter-disciplinary. Further discussion and interest to pursue a National Science Foundation grant to support extra workshop options will take place at the upcoming WRS Water Resources Science Retreat on March 21-22, 2015.

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ring 2015 Resources and Publications

cterization of Chironomidae (Diptera) Surface-Floating Pupal Exuviae Sample Sort Time from Coastal Tropical tic Systems

felder, P. and L.C. Ferrington, Jr.

Environmental Monitoring and Assessment 87(3): 1-8.

studies either ignore chironomids or only identify specimens to subfamily or tribe due to the associated difficulty and ost with processing and identifying larvae. An efficient form of sampling chironomids involves collections of surface-floating pupal exuviae (SFPE). SFPE sample sorting has been shown to be more time efficient than traditional dip-net methods in temperate urban and peri-urban streams.

Survivorship and longevity of adult Diamesa mendotae Muttkowski, 1915 (Diptera: Chironomidae) at controlled, sub-freezing temperatures

Mazack J. E., P. Kranzfelder, A. M. Anderson, R. W. Bouchard, J. Perry, B. Vondracek, and L. C. Ferrington. 2015. Aquatic Insects: 1-8.

Our results indicate that overall survivorship is negatively related to treatment duration of sub-freezing treatment, individuals can survive sub-freezing temperatures for at least 70 days, with total longevity of 92 days. Additionally, males had a significantly higher rate of survivorship than females within treatments. Total longevity increased with treatment time, suggesting adult D. mendotae may survive long periods of below-freezing temperatures under natural conditions before mating, which may convey population-level advantages.

Differential Efficiencies of Dip-Net Sampling Versus Sampling Surface-Floating Pupal Exuviae in a Biodiversity Survey of Chironomidae

Ferrington L. C. and W. P. Coffman. 2014. CHIRONOMUS Newsletter on Chironomidae Research 27: 31-40.

Relative efficiencies of standard dip-net sampling (SDN) versus collections of surface-floating pupal exuviae (SFPE) were determined for detecting Chironomidae at catchment and site scales and at subfamily/tribe-, genus- and species-levels based on simultaneous, equal-effort sampling on a monthly basis for one year during a biodiversity assessment of Bear Run Nature Reserve. Results showed SFPE was more efficient than SDN at catchment scales for detecting both genera and species

Factors Affecting Decomposition Rates of Chironomid (Diptera) Pupal Exuviae

Kavanaugh R. G., A. T. Egan, and L. C. Ferrington. 2014.

CHIRONOMUS Newsletter on Chironomidae Research 27: 16-24.

Collections of floating chironomid pupal exuviae are used to monitor water quality and assess ecological conditions. Factors controlling exuviae sinking rates are not well known, although they should have an effect on conclusions that can be drawn from collections. The current study was conducted to determine the rate of sinking under controlled laboratory conditions using water from three streams with different nutrient levels.

Spatial arrangement and metrics of freshwater coastal rock pools applied to amphibian conservation

Egan A. T., L. C. Ferrington Jr, T. Lafrançois, M. B. Edlund, and J. McCullough. 2015.

Limnologica – Ecology and Management of Inland Waters 51: 101-109.

Coastal habitats are an ecotone between aquatic and terrestrial ecosystems. Depressions on volcanic bedrock shores of Lake Superior form small pool habitats that are influenced to various degrees by their spatial context and that relate to differences in mechanisms of disturbance. A total of 71,931 coastal pools were mapped and measured, and amphibian occupants were identified along 48 km of shoreline at Isle Royale National Park, where coastal rock pool habitats were abundant.

MnTOPO is a web application for viewing, printing and downloading high-resolution elevation data for the State of Minnesota that was collected using LiDAR technology. It runs on a variety of devices including desktop PCs, tablets, and mobile phones.

arcgis.dnr.state.mn.us/maps/mntopo/

MnTOPO data and downloads are made possible by the Minnesota elevation mapping project.

Minnesota Weather Almanac (second edition)

Mark W. Seeley, April 2015. Minnesota Historical Society Press

This book is organized by season and showcases a wide variety of data and lore from weather and climate episodes of the past. It also features stories about people and events related to the state's rich weather history. Maps, tables, and graphics serve to convey the important data, and several historical photos illustrate important events. The last chapter of the book deals with the evidence for climate change and its consequences in our state. 344 pages.

The **WDCP Calendar** for 2015 workshops is live: www.mnwetlands.umn.edu/trainingcourses/index.htm

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ring 2015 Student News

s Wisker received his MS Degree December, 2014. His thesis was titled: Balanced Urban Ecology and the ulization of Minnehaha Creek: Bridging the Land-Use Water Governance Gap. Wisker was advised by Bruce Wilson.

omez-Smith, won a best student paper award for her presentation "Characterization of Drinking Water Distribution m Biofilm Communities Using Next-Generation Illumina Sequencing of 16S Rrna." at the Water Quality Technical rence (a conference of the American Water Works Association) in New Orleans LA, November 16-20, 2014. Gomez-Smith is advised byRay Hozalski and Tim LaPara.

New WRS faculty:

Sebastian Behrens

PhD From: University of Bremen, Germany [Microbial Ecology, 2003]

Behrens is Associate Professor in the Department of Civil, Environmental, and Geo-Engineering at the University of Minnesota- Twin Cities. His research is primarily focused on environmental biotechnology, biogeochemistry, and microbial ecology.

Andrew Bramburger

PhD From: University of Windsor [Environmental Science, 2011]

Bramburger is a Research Associate at the University of Minnesota-Duluth at the Natural Resources Research Institute. His primary research interests are related to the relative influence of multiple stressors on algal communities and the use of algae as indicators of impacts to aquatic ecosystems.

Ralph Garono

PhD From: Kent State University [Aquatic Ecology, 1993]

Garono is currently a Research Associate at the University of Minnesota-Duluth. His current research interests focus on assessments, at multiple spatial and temporal scales, of aquatic and marine ecosystems. His research projects include: the

use of aquatic insects as a wetland assessment tool; GIS-based watershed assessments; the use of GIS-based models to evaluate alternative land use scenarios; and, the use of hyperspectral imagery to map landscape patterns in intertidal estuarine vegetation. He currently is the chair of the Society of Wetland Scientists Human Diversity Committee.

Kathryn Schreiner

PhD From: Texas A&M University [Oceanography, 2013]

Schreiner is an Assistant Professor at the Large Lakes Observatory (LLO) at the University of Minnesota-Duluth. Her research interests include carbon cycling and storage in lakes and lake sediments, the quantification and identification of terrestrial carbon sources to aquatic and marine systems, and the impacts of environmental change (climate warning, land use change, invasive species, etc.) on carbon cycling.

Byron Steinman

PhD From: University of Pittsburgh [Geology and Planetary Science, 2011]

Steinman is an Assistant Professor in the Department of Earth and Environmental Sciences and the Large Lakes Observatory (LLO) at the University of Minnesota-Duluth. His research is primarily focused on reconstructing how climate has changed through time in various regions around the world including the Americas (North, South, and Central) and Asia using geochemical analyses of lake sediment.

Santiago Romero-Vargas Castrillón

PhD From: Princeton University [Chemical Engineering, 2012]

Romero-Vargas Castrillón is an Assistant Professor in the Department of Civil, Environmental, and Geo-Engineering at the University of Minnesota- Twin Cities. His major research interests include membrane-based processes for water treatment; membrane fouling; environmental nanotechnology; environmental colloid and surface science.

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ring 2015 Upcoming Events

y 25-28, 2015
GLR's 58th Annual Conference on Great Lakes Research

gton, VT

lays of scientific sessions and speakers focusing on the theme New Views New Tools

September 14-15, 2015
Clean Water Summit

Green Infrastructure - the stormwater, groundwater, surface water connection

October 13-14, 2015
Minnesota Water Conference

RiverCentre

St. Paul, MN

The Minnesota Water Resources Conference presents innovative, practical, and applied water resource engineering solutions, management techniques, and current research about Minnesota's water resources.

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